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PATENT APPLN. NO. 10/792,281  
RESPONSE UNDER 37 C.F.R. §1.111

PATENT  
NON-FINAL

REMARKS

*Claim Rejections - 35 USC § 112/§ 103*

The Office is rejecting claims 1 and 5, the only claims remaining in the application, as failing to comply with the description requirement of the first paragraph of 35 U.S.C. § 112 and as being indefinite under the second paragraph of 35 U.S.C. § 112. Both of these rejections relate to the amendment to claim 1 that were made in the response filed November 20, 2007, to recite that in the lithium secondary battery of the present invention, the nonaqueous solvent of the nonaqueous electrolyte "consists of"  $\gamma$ -butyrolactone.

The Office is taking the position that this limitation is new matter because the specification does not provide support for a nonaqueous electrolyte in which the solvent is only  $\gamma$ -butyrolactone. The Office is also taking the position that it is unclear from the claim whether vinylene carbonate and vinyl ethylene carbonate are present in the nonaqueous electrolyte because both compounds are known in the prior art as solvents for use in a nonaqueous electrolyte, but claim 1 limits the solvent to  $\gamma$ -butyrolactone.

In view of the alleged indefiniteness of claim 1, the Office is interpreting the claim as being limited to a nonaqueous

electrolyte that contains  $\gamma$ -butyrolactone as the only solvent and that does not contain vinylene carbonate and vinyl ethylene carbonate and is rejecting claims 1 and 5 under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as being unpatentable over Sato et al., U.S. Patent Application Publication No. 2002/0009649 ("Sato").

*Response*

Applicants respectfully submit that the 35 U.S.C. § 112 rejections are neither proper nor reasonable. First, regarding the rejection for new matter, the specification in paragraph [0021] describes that other solvents "can" be added to the nonaqueous electrolyte having  $\gamma$ -butyrolactone as the main solvent. Paragraph [0021] also describes that the amount of  $\gamma$ -butyrolactone is "preferably not less than 90 % by volume, more preferably, not less than 95 % by volume, and, most preferably, not less than 97 % by volume, in the nonaqueous electrolyte." Amounts of "not less than" a specified percentage do not limit the amount of the  $\gamma$ -butyrolactone.

Second, regarding the rejection for indefiniteness, claim 1 recites that the nonaqueous electrolyte "includes" vinylene carbonate and vinyl ethylene carbonate. Regardless of how the Office identifies vinylene carbonate and vinyl ethylene carbonate,

it cannot properly exclude them from the claims. Also, vinylene carbonate and vinyl ethylene carbonate are at least sometimes referred to in the prior art as additives to a nonaqueous electrolyte and not as solvents (for example, the following U.S. patents identify vinylene carbonate and/or vinyl ethylene carbonate as additives to a nonaqueous electrolyte: U.S. Patent Nos. 7,300,722; 7,255,965; 7,097,944; and 7,026,074) and, therefore, the claim is proper.

Notwithstanding that the claims as examined comply with the requirements of the first and second paragraphs of 35 U.S.C. § 112, claim 1 has been amended to recite that the nonaqueous solvent consists of not less than 97 % by volume of  $\gamma$ -butyrolactone and at least 0.1 part by weight of vinylene carbonate and at least 0.1 part by weight of vinyl ethylene carbonate in 100 parts by weight of the nonaqueous electrolyte. This amendment is supported by paragraph [0021] as noted above.

Regarding the rejection of claims 1 and 5 under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as being unpatentable over Sato, this rejection is based on the interpretation of the claims as being limited to a nonaqueous electrolyte that contains  $\gamma$ -butyrolactone as the only solvent and that does not contain vinylene carbonate and vinyl ethylene

carbonate. This rejection has been mooted by the amendment to claim 1.

Moreover, Sato does not otherwise support a rejection of the claims as amended under either 35 U.S.C. § 102 or 35 U.S.C. § 103(a).

Sato discloses a polymer battery comprising an ionic conductive salt, a solvent capable of dissolving the ionic conductive salt and a compound having not less than two reactive double bonds in a molecule.  $\gamma$ -Butyrolactone is disclosed as a useful solvent, but Sato does not teach or suggest how to suppress decomposition of  $\gamma$ -butyrolactone on a carbon electrode so as to obtain a lithium secondary battery having excellent heat stability as well as having sufficient discharge characteristics and storage characteristics.

The present invention provides a lithium secondary battery comprising a positive electrode, a negative electrode including a carbon material having a ratio ( $I_b/I_c$ ) of a Raman spectrum intensity (R) obtained by Raman spectroscopy of 0.2 or greater, and an electrolyte comprising a solute dissolved in a nonaqueous solvent consisting of not less than 97 % by volume of  $\gamma$ -butyrolactone and containing VC and VEC as additives to inhibit, significantly, decomposition of the  $\gamma$ -butyrolactone and to provide excellent

charge and discharge characteristics. The elements of the lithium secondary battery of the present invention are not anticipated and would not have been obvious from the battery of Sato.

The claims as amended are also patentable over the combination of U.S. Pre-grant Publication No. 2004/0101763 ("Kotato") and U.S. Patent No. 6,022,518 ("Yamazaki") and the combination of Kotato, Yamazaki and JP 2001-297794 cited in the prior actions in the application.

Kotato (2004/0101763) discloses an electrolyte comprising a solvent containing not less than 50 % by volume of  $\gamma$ -butyrolactone and not less than 10 % by volume of ethylene carbonate (EC); and 0.01 ~ 5 % by weight each of VC and VEC (total amount of VC and VEC is 0.02 ~ 6 % by weight) as an additive. Kotato identifies Japanese Patent Application Laid-open Publication No. 2000-235868 ("JP 2000-235868 as prior art disclosing an electrolyte including 50 ~ 95 % by volume of  $\gamma$ -butyrolactone, and further including EC and VC.

Kotato cannot be properly modified to include an amount of  $\gamma$ -butyrolactone of not less than 97% by volume in the nonaqueous electrolyte as recited in amended claim 1 because Kotato requires that the nonaqueous electrolyte include ethylene carbonate in an amount of 10% by volume or more (see paragraph [0017]). The Office

has not provided proper reasoning or evidence to support its position that a person of ordinary skill in the art would have been motivated (for example, by the teachings of JP 2001-297794) to modify the battery of Kotato to include an amount of  $\gamma$ -butyrolactone of more than 90% by volume in the nonaqueous electrolyte and to expect good results when Kotato discloses that amounts of greater than 90% by volume, e.g., 95% by volume as disclosed in Japanese Patent Application Laid-open Publication No. 2000-235868, do not provide good results. Moreover, as has been previously noted, a reference cannot be properly modified where the modification would destroy the invention on which the reference is based. (See *Ex parte Hartmann*, 186 USPQ 366 (Bd. App. 1974)). The proposed modification of Kotato will destroy the invention of Kotato, i.e., an electrolyte comprising a solvent containing not less than 10 % by volume of ethylene carbonate (EC).

For these reasons, the combinations of Kotato with the references identified above cannot support a case of *prima facie* obviousness.

Moreover, it is noted that in the present invention, in which the lithium secondary battery includes an electrolyte in which a solute is dissolved in a nonaqueous solvent consisting of not less than 97 % by volume of  $\gamma$ -butyrolactone, the negative electrode

includes, as an active material, a carbon material having a ratio ( $I_b/I_c$ ) of a Raman spectrum intensity (R) obtained by Raman spectroscopy of 0.2 or greater, and VC and VEC are included as additives to prevent of decomposition of the  $\gamma$ -butyrolactone and to obtain excellent charge-discharge characteristics. That is, as a negative electrode, a first carbon material having high crystallinity as a core material is at least partially coated by a second carbon material having lower crystallinity than the first carbon material to provide an R value of not less than 0.2. Furthermore, VC and VEC are used as additives to form a fine film having excellent permeability of lithium ion on the surface of the amorphous carbon material, and to prevent decomposition of  $\gamma$ -butyrolactone at the interface between the negative electrode and the nonaqueous electrolyte (see paragraph [0016] of the present specification).

The carbon material used for the negative electrode of the battery of the present invention is different than that disclosed in Yamazaki. Yamazaki discloses a carbon material having not greater than 0.45 of R to improve characteristics of a battery at a low temperature and to improve cycle characteristics. There is a description that the surface is graphitic and the core is carbonaceous. This carbon material is inherently different from

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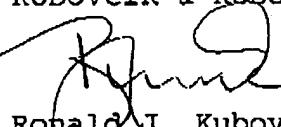
that of the present invention. Apart from the differences in the non-aqueous electrolyte explained above, use of the carbon material of Yamazaki in the battery of Kotato will not result in the battery of the present invention.

For these reasons also, the proposed modification of Kotato, even if assumed arguendo to be proper, would not have resulted in the lithium secondary battery of the present invention.

A notice of allowability of the claims of the application is believed to be in order and is respectfully solicited.

In the event that this paper is not considered to be timely filed, applicants hereby petition for an appropriate extension of time. The fee for any such extension and any additional required fees may be charged to our Deposit Account No. 111833.

Respectfully submitted,  
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